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Double-Row Repair Technique for Bursal-Sided Partial-Thickness Rotator Cuff Tears

Hytham Salem, B.A., Aaron Carter, M.D., Fotios Tjoumakaris, M.D., and Kevin B. Freedman, M.D.

Abstract: Rotator cuff pathology is a common cause of shoulder pain in the athletic and general population. Partial-thickness rotator cuff tears (PTRCT) are commonly encountered and can be bursal-sided, articular-sided, or intra-tendinous. Various techniques exist for the repair of bursal-sided PTRCTs. The 2 main distinctions when addressing these lesions include tear completion versus preservation of the intact fibers, and single- versus double-row suture anchor fixation. We present our method for addressing bursal-sided PTRCTs using an in situ repair technique with double-row suture anchors.

Shoulder pain is the third most common musculoskeletal complaint in the adult population, and patients seeking medical care for shoulder pain are most likely to be suffering from rotator cuff pathology.¹ Tears of the rotator cuff may be full- or partial-thickness, with partial-thickness rotator cuff tears (PTRCTs) further divided into bursal surface, articular surface, and intratendinous tears. Although the indication for surgical treatment of PTRCTs has not been clearly established, arthroscopic or open repair is generally recommended in active patients that exhibit pain and weakness refractory to conservative treatment, and in tears that involve more than 50% of tendon thickness or are greater than 2 cm in diameter.²

The surgical treatment of PTRCTs differs on the basis of whether the intact portion of the tendon is preserved or sacrificed. In the latter method, the partial tear is converted to a full-thickness tear and then anchored to

the original footprint. Alternatively, an in situ repair technique involves the fixation of the torn cuff tissue to the footprint whereas the intact portion and its attachment are preserved. Various techniques have been employed in an attempt to preserve intact articular tendon fibers while repairing bursal cuff tissue.^{3,4} We present our method for addressing bursal-sided PTRCTs using an in situ repair technique with double-row suture anchors.

Technique

The following surgical technique can be performed with the patient in either a beach chair or lateral decubitus position. After the operative shoulder is appropriately prepped and draped, a timeout is performed to confirm the operative site. A standard posterior viewing portal is established and the arthroscope is introduced into the shoulder. The anterior portal is then established in the rotator interval and any intra-articular pathology is addressed. The articular-sided rotator cuff insertion is carefully examined with the arm in abduction and external rotation from the posterior viewing portal.

Once the articular-sided cuff insertion is confirmed to be intact, the arthroscope is transitioned to the sub-acromial space. A direct lateral viewing portal is used, and a complete bursectomy is performed. In addition, since most bursal sided rotator cuff tears are associated with impingement, an arthroscopic acromioplasty is performed with a motorized burr using a cutting block technique. An additional anterolateral portal just off the acromial border is then established with an 8.25-mm cannula to serve as the primary working portal to

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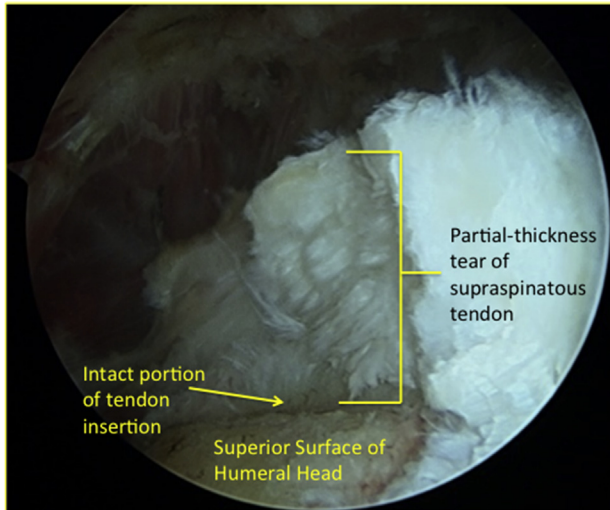


Fig 1. With the patient in the beach chair position, arthroscopic imaging from the lateral viewing portal shows a partial-thickness bursal-sided rotator cuff tear of the left supraspinatus tendon after debridement.

accommodate anchor placement and passage of sutures. The footprint of the rotator cuff is probed and carefully debrided to avoid any damage to intact fibers of the cuff insertion (Fig 1). Through the anterolateral portal, microfracture of the tuberosity is typically performed to create a bleeding surface to promote healing. A triple-loaded Healix Advance 5.5-mm Peek Suture Anchor with Orthocord (DePuy Mitek, Raynham, MA) is then placed at the most medial margin of the exposed

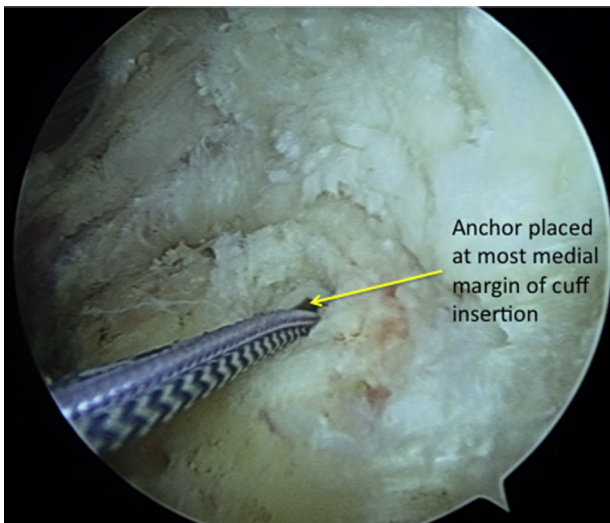


Fig 2. With the patient in the beach-chair position, arthroscopic imaging from the lateral viewing portal shows the placement of a triple-loaded Healix Advance 5.5-mm Peek Suture Anchor with Orthocord (DePuy Mitek) placed at the most medial margin of the intact supraspinatus tendon insertion to create the medial row.

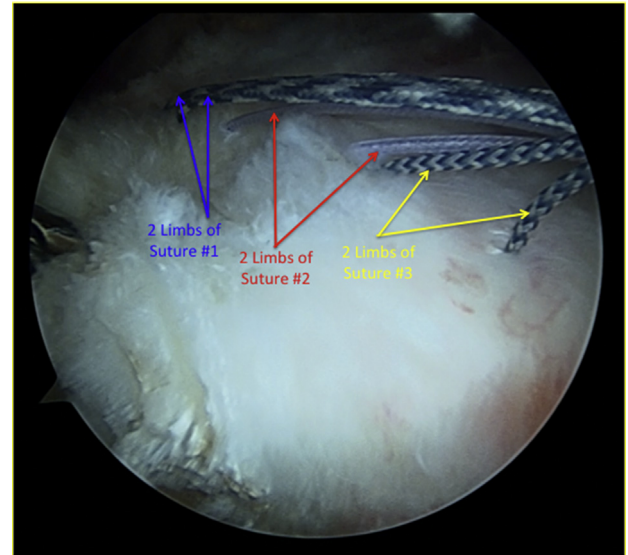


Fig 3. Arthroscopic imaging of the left shoulder from the lateral viewing portal shows the placement of 3 individual horizontal mattress sutures placed through the rotator cuff tissue.

footprint to create the medial row (Fig 2). An ExpressSew II (DePuy Mitek) flexible suture passer or Spectrum II (ConMed Linvatec, Utica, NY) is then used to pass the individual suture limbs of the same color through the rotator cuff flap in a horizontal mattress fashion. This step is repeated for each of the color-coded limbs of the suture anchor. Careful attention is focused on the spread of suture limbs across the cuff tear to ensure adequate

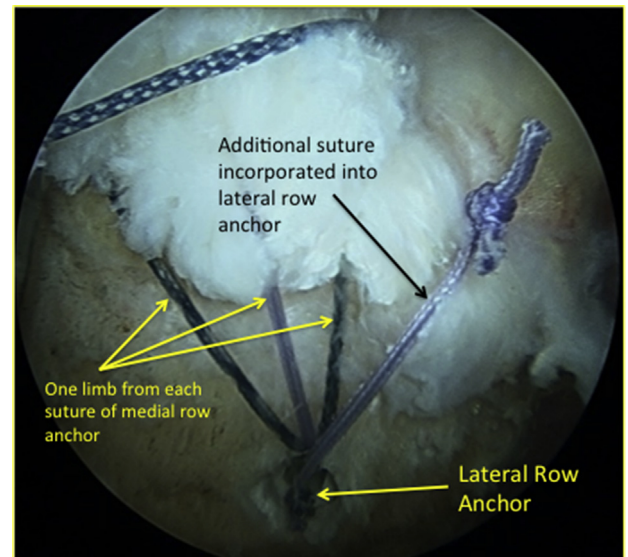


Fig 4. Arthroscopic imaging of the left shoulder from the lateral viewing portal shows the placement of a lateral-row anchor with an additional suture incorporated into the lateral-row anchor at the time of insertion to further reduce the cuff tissue to the footprint.

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> ◆ An extra suture can be incorporated into lateral-row anchors to further reduce rotator cuff tissue ◆ Careful attention should be focused on the spread of medial-row suture limbs across cuff tear to ensure adequate reduction 	<ul style="list-style-type: none"> ◆ Careful attention must be paid during debridement to avoid damage to intact articular fibers

reduction (Fig 3). The medial row is then tied with a sliding knot and alternating half hitches. Once the medial-row sutures are tied, one limb from each horizontal mattress suture is loaded through the end of a Footprint Ultra PK 4.5-mm Suture Anchor (Smith & Nephew, Andover, MA). A pilot hole is prepared at the lateral edge of the greater tuberosity through the anterolateral portal. The Footprint anchor is advanced through the pilot hole completing the lateral row and reducing the cuff tear. Each suture limb can be individually tensioned. Of note, an additional suture can be incorporated into the lateral-row anchor prior to insertion at the surgeon's discretion (Fig 4). This suture can then be passed through cuff tissue and tied with a simple knot to further reduce any cuff tissue to the footprint (Table 1). For most repairs, a single lateral-row anchor is used with the medial-row sutures forming a "parachute" over the tendon edge (Fig 4). If 2 lateral-row anchors are to be used, the remaining limbs from each mattress suture are incorporated into the additional anchor and placed into the greater tuberosity (Fig 5). If a single lateral-row anchor is used, each of the remaining single mattress sutures from the medial row can be cut (Fig 6).

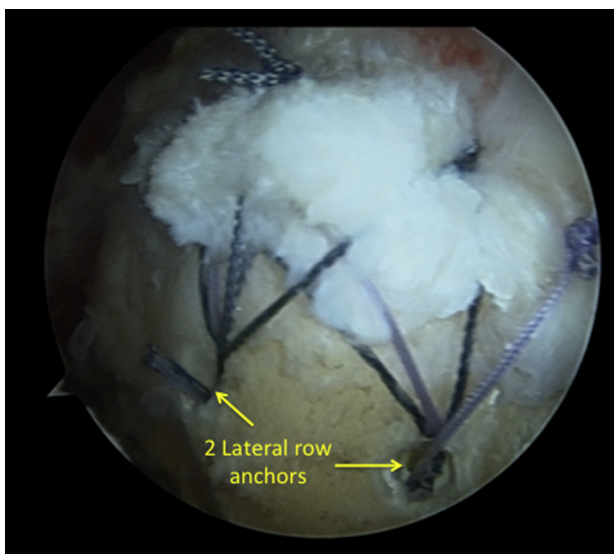


Fig 5. Arthroscopic imaging of the left shoulder from the lateral viewing portal shows the completed repair of a partial-thickness bursal-sided rotator cuff tear with 2 lateral anchors.

Rehabilitation

Postoperative rehabilitation protocol involves a brief period of immobilization followed by gradual progression of motion and strength, with eventual return to full activity and sport. During the first phase (0-4 weeks), the arm is placed in a sling with a supportive abduction pillow. Range of motion during this phase is limited to passive motion as tolerated by the patient, and therapeutic exercises include Codman's exercise, grip strengthening, and isometric scapular stabilization. In the second phase (4-8 weeks), the immobilizer is discontinued and gentle passive stretching is progressed to 160° of forward flexion, 60° external rotation with arm adducted, and abduction to 60° to 80°. Range of motion can be increased gradually as tolerated until 8 weeks postoperatively. Therapeutic exercises in phase II include gentle active exercises at 4 to 6 weeks with the commencement of deltoid and biceps strengthening at 6 to 8 weeks. At phase III (8-12 weeks), range of motion is progressed to full motion without discomfort. Scapular strengthening exercises are continued and internal/external strengthening exercises are begun. In the fourth and final phase (12-20 weeks), phase III exercises are advanced, and sport-specific activities are begun with an emphasis on the maintenance of flexibility and the increase of motion velocity (Table 2).

Discussion

With current methods for the surgical repair of rotator cuff tears trending away from open procedures and toward arthroscopy, the ideal arthroscopic technique for restoring anatomy of the footprint and optimizing

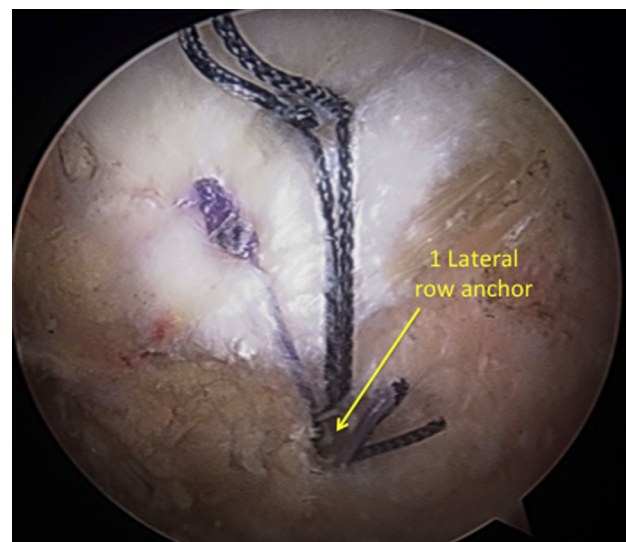


Fig 6. Arthroscopic imaging of a right shoulder from the lateral viewing portal shows the completed repair of a partial-thickness rotator cuff tear with a single lateral-row suture anchor.

Table 2. Rehabilitation Program After Repair

	Range of Motion	Immobilizer	Therapeutic Exercise
Phase I (0-4 weeks)	Passive range only—to tolerance	Sling with supporting abduction pillow to be worn at all times except for hygiene and therapeutic exercise	Codman's, elbow/wrist/hand ROM, grip strengthening, isometric scapular stabilization
Phase II (4-8 weeks)	4-6 weeks: Gentle passive stretch to 160° of forward flexion, 60° external rotation at side, and abduction to 60°-80° 6-8 weeks: increase ROM to tolerance	None	4-6 weeks: Begin gentle active assistive/active exercises, begin gentle joint mobilizations (grade I and II), continue with phase I exercises 6-8 weeks: Begin active exercises and deltoid/biceps strengthening
Phase III (8-12 weeks)	Progress to full motion without discomfort	None	Continue with scapular strengthening, progress exercises in phase II, begin internal/external rotation isometrics, stretch posterior capsule when arm is warmed up
Phase IV (12 weeks-5 months)	Full motion without discomfort	None	Advance exercises in phase III, begin sport-specific activities, maintain flexibility, increase velocity of motion, return to sport activities

clinical outcomes is worthy of investigation. Currently, there is still debate regarding the best method to treat partial-thickness rotator cuff tears.

Shin⁵ found that the tear completion method leads to faster recovery of function and range of motion but diminished tendon integrity as evidenced by magnetic resonance imaging findings. Conversely, the in situ method in which the intact portion of the tendon is left undisturbed maintains the anatomic tendon footprint without disrupting the biomechanics of the rotator cuff.⁵ A recent prospective study by Kim et al.⁶ evaluated the outcomes of in situ repair versus tear completion repair for PTRCTs. In their technique, mattress sutures were passed through both bursal cuff tissue as well as the intact tendon fibers prior to anchor fixation. The in situ technique resulted in a lower retear rate among patients with bursal-sided PTRCTs compared with the tear completion method. Our described technique employs mattress sutures through only the bursal cuff tissue with the medial-row anchor placed adjacent to the remaining footprint. This further

limits the disruption of intact cuff fibers and, possibly, alteration of their biomechanics.

Anatomic studies have revealed that the placement of a lateral-row anchor further reinforces this construct. Tuoheti et al.⁷ found that double-row repairs lead to 60% greater contact area than single-row constructs, thereby promoting a better environment for tendon healing (Table 3). In a cadaveric study by Mazzocca et al.,⁸ a significantly greater supraspinatus footprint width was observed with double-row techniques compared with single-row repair.

In conclusion, an in situ repair technique with double-row suture anchors is our preferred method of addressing bursal-sided partial-thickness rotator cuff tears (Video 1). It provides excellent fixation of the rotator cuff tissue while preserving the anatomy of the medial footprint.

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Table 3. Advantages and Disadvantages

Advantages	Disadvantages
◆ Greater tendon-bone contact area is achieved with a double-row technique compared with single-row constructs	◆ Entire thickness of cuff tissue not incorporated into repair with our proposed technique
◆ Preserved integrity of anatomic footprint with an in situ method compared with the tear-completion method	◆ May be more technically demanding than the tear completion method

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